

Personal Data

Name: Robert B. Caton, Ph.D., QEP
Occupation: Air Quality Management Specialist
Position in Firm: Project Director

PROFILE

Dr. Bob Caton is a physical scientist with more than 25 years' experience in projects, programs and business management related to environmental management, assessment, and research. His expertise covers a broad range: from strategic planning, regulatory programs and policy development, to environmental management systems and auditing. He is competent in a variety of technical areas, including: air emissions, air quality impact assessment and management; benefit-cost analysis of air quality management and climate change mitigation; hazard and risk assessment and environmentally-driven technology development and assessment.

QUALIFICATIONS

QEP, Qualified Environmental Professional	1993-2003
Institute of Professional Environmental Practice (US)	
Ph.D. Physical Chemistry, University of Rochester (NY)	1967
B.A. Chemistry (Honors), Hamilton College (NY)	1963

EMPLOYMENT

RWDI West Inc., Vancouver Project Director	2001 -
Alchemy Consulting Inc., Vancouver President and Principal Consultant	1996 - 2001
BOVAR Environmental, Vancouver Regional Manager and Manager, Environmental Management Services	1994 - 1996
Concord Environmental Corporation Toronto and Vancouver, Vice President	1980 - 1994
Ontario Ministry of the Environment, Air Resources Branch: Head, Hazardous Contaminants and Research Planning Unit	1975 - 1980
University of Toronto, Department of Chemistry Assistant Professor	1969 - 1975
National Research Council, Ottawa Postdoctoral Research Fellow	1967 - 1969

PROFESSIONAL AFFILIATIONS

Air & Waste Management Association
Past Chair, B.C. & Yukon Chapter
Past Director, Pacific Northwest International Section (PNWIS)
American Chemical Society
Institute of Professional Environmental Practice (QEP Certificate #11930044)
Canadian Environment Industry Association, BC Chapter
Canadian Institute of Energy, Vancouver Chapter

SELECTED CONSULTING EXPERIENCE

Climate Change and Greenhouse Gas Management

Acted as project director and senior analyst for studies related to greenhouse gas emissions management and related economic instruments:

- Senior Analyst, development of basis for a greenhouse gas mitigation action plan for measures to be integrated with the Greater Vancouver and Fraser Valley Air Quality Management Plan (2000/1, Sheltair Group/GVRD).
- Senior Advisor, National Climate Change Process, Analysis & Modelling Group, Environmental & Health Impacts Sub-Group, integration of AMG findings with the EHI common air contaminant emission estimates, air quality analysis and co-benefits valuation; participant in several Climate Change Economic Analysis Forum workshops (2000, Environment Canada).
- Senior Advisor, Canadian Council of Ministers of the Environment (CCME), integration of linkages among air quality issues and greenhouse gas management for climate change mitigation (2000, Canadian Council of Ministers of the Environment).
- Senior author, preliminary analysis of air quality co-benefits from reduced greenhouse gas emissions in Canada (2000, David Suzuki Foundation).
- Project manager, development of a strategy for managing potential emission reduction credits for landfill gas collection and utilization (1999/2000; City of Vancouver).
- Senior consultant, development of an evaluation tool for proposed approaches to a credit for early action program for Canada (1999; Credit for Early Action Issue Table, National Climate Change Process and Environment Canada).
- Senior consultant, assessment of health & environmental impacts of greenhouse gas mitigation options (1999; Electricity Industry Issue Table, National Climate Change Process).
- Senior consultant and interim Coordinator, corporate greenhouse gas strategic planning and management for a major electrical utility (1998-99; BC Hydro, Corporate Environment).
- Project manager, development of design requirements for a greenhouse gas offsets emission reduction credit trading pilot project for B.C./Canada—eventually implemented as the national GERT Pilot (1996-97; Environment Canada and B.C. Ministry of Employment & Investment).
- Project manager, background document on a municipality's role in greenhouse gas management (1994; Greater Vancouver Regional District).
- Project manager, B.C. emission inventory of nitrogen oxides, volatile organic compounds and ozone as greenhouse gases (1991-92; B.C. Ministry of Environment).
- Senior consultant, greenhouse gas emissions and offsets assessment, Island Cogeneration Project application for Project Approval Certificate to the B.C. Environmental Assessment Process (1997-8. Fletcher Challenge Energy/Westcoast Power).

- Senior consultant, identification and evaluation of potentially economic greenhouse gas and nitrogen oxides emission offsets (1997/8. Constable Associates/BC Hydro).
- Senior consultant, identification and evaluation of potentially economic greenhouse gas offsets related to electricity trade (1997/8. Constable Associates/Powerex).
- Project manager, development of greenhouse gas emission factors for Environment Canada's Residual Discharge Information System, RDIS (1992-93; Environment Canada).
- Senior advisor, development for the Canadian natural gas industry of regional greenhouse gas emission factors for energy conversion technologies (1995; Gas Technology Canada/Canadian Gas Association).
- Project manager, development of a full-fuel-cycle, interactive emission model for greenhouse gases and conventional pollutants for the major B.C. natural gas gathering, processing, transmission and marketing system in Canada and the U.S. (1994-95; Westcoast Energy Inc.).
- Project director and senior analyst, development of a corporate greenhouse gas management strategy; corporate emission inventory; background documentation and analysis; workshop facilitation, policy drafting for a major electrical utility (1994-96; BC Hydro).
- Author, backgrounder on transboundary environmental issues for British Columbia, including global warming and long-range transport of air pollutants (1990; B.C. Round Table on the Environment and the Economy).

Air Quality Impacts of Vehicles and Fuels

Directed studies for policy and regulation development for vehicle technology and fuels for British Columbia and Canada:

- Project manager and senior analyst, cost-benefit evaluation of policy options for vehicle tailpipe emission standards in BC and alternative transit options in the Vancouver region (1999/2000; consortium of public and private sector agencies).
- Senior analyst, assessment of diesel particulate emissions and their air quality and health implications in the Greater Vancouver Region (1999/2000; Levelton Engineering/GVRD).
- Member, Atmospheric Science Expert Panel, Joint Industry/Government Study of sulphur in gasoline and diesel fuels - scientific analyst and advisor to Environment Canada and the Canadian Petroleum Products Institute on benefits and costs of reducing sulphur content of gasoline and diesel fuels; developed probabilistic emission model for the Panel (1996-97; Joint Industry/Government Study Secretariat)
- Senior analyst, evaluation of emission reduction benefit of the BC Scrap-It older vehicle early retirement pilot program (1997; Constable Associates/Scrap-It Steering Committee)
- Project director, benefit-cost analysis of changes to vehicle technology and fuels in British Columbia and Canada - analyst and advisor to B.C. Ministry of Environment and Canadian Council of Ministers of the Environment (1995-96; B.C. Ministry of Environment).
- Peer reviewer, B.C. risk analysis of benzene content of gasoline (1995; B.C. Ministry of Environment).
- Project manager, feasibility study of an older vehicle scrapping program for B.C. (1995; British Columbia Lung Association).
- Project manager, review and assessment of environmental and health impacts of emissions from the transportation sector (1992; Environment Canada).

- Project manager, transportation sector emissions in ARPEL member countries (1994-5, BOVAR Environmental/Petro-Canada International/CIDA).
- Project manager, seminars in Bogota (Villa de Leyva), Colombia on 'Control of the Urban Environmental Impact from Vehicle Emissions' for ARPEL member countries (1992-3, Concord Environmental/ARPEL-Ecopetrol/CIDA).

Urban and Regional Air Quality Management

Directed or participated as senior analyst in a number of studies related to air quality planning for a major urban area, Vancouver, British Columbia, from 1988 to 1999:

- Project manager, development of a discussion paper on strategic air quality management planning for the Lower Fraser Valley, British Columbia (1998/99; Greater Vancouver Regional District/BC Ministry of Environment, Lands & Parks/Environment Canada).
- Senior analyst, development of hazardous air pollutants management strategy (1997/8; Levelton Engineering/Greater Vancouver Regional District).
- Chair, Scientific Advisory Panel and senior report editor for Stage 1 of the development of the Greater Vancouver Regional District Air Quality Management Plan – the first such plan in Canada (1988-89; Greater Vancouver Regional District).
- Project director, comprehensive air quality trend assessment for the Lower Fraser Valley, British Columbia (1993; Greater Vancouver Regional District).
- Project director, chemical mass balance source apportionment of fine particle pollution in the Greater Vancouver Region (1993; Environment Canada).
- Project director, issue identification and program recommendations for inhalable particle (PM₁₀) control program in the Lower Fraser Valley (1996; Greater Vancouver Regional District).
- Project director and senior analyst, cost-benefit analysis of Greater Vancouver Regional District's Air Quality Management Plan (1993-94; Greater Vancouver Regional District, Environment Canada, B.C. Ministry of Environment).
- Project director and senior analyst, probabilistic economic evaluation of air quality improvement in the Lower Fraser Valley, B.C. (1994-95; B.C. Ministry of Environment).
- Author, background paper on air quality issues in British Columbia—used as the focus document for the 1991 provincial workshop on a clean air strategy (1990; BC Round Table on the Environment and the Economy).

Thermal Power Generation Impact Assessment

Project director or senior analyst for projects related to the development and operation of thermal electrical power generation:

- Analyst, cost-benefit analysis of BC Hydro's Burrard Thermal Generating Plant; multiple account analysis of financial, social and environmental elements of current and future operating scenarios (2001; BC Crown Corporations Secretariat/Marvin Shaffer & Associates).
- Consultant, potential for benchmarking facility and grid system greenhouse gas and conventional pollutant emissions in electrical power purchases (2000; BC Hydro).
- Project Manager, air quality impact assessment of a proposed gas turbine power plant in northeastern B.C.; successful application for Project Authorization Certificate from B.C. Environmental Assessment Office (1998; BC Hydro).
- Senior analyst, development of all environmental elements of Social Evaluation Reports for four proposed projects in response to BC Hydro's call for independent power supply - two short-

listed and selected (1994-97; Fletcher Challenge Energy, Westcoast Power, Stothert Engineering, Triton Consultants).

- Project manager, modelling and air quality impact assessment of Burrard Thermal Generating Plant Greater Vancouver Regional District permitting requirements (1993; BC Hydro).
- Project manager, Burrard Thermal Generating Plant 25-Year Utilization Study: environmental overview; air quality impacts, effects criteria and technology assessment of a 960-MW, gas-fired power plant in Vancouver; expert testimony at British Columbia Utilities Commission hearings for an Energy Removal Certificate *re* power export (1991-92; BC Hydro).
- Senior analyst, estimation of social (damage) costs to human health of emissions from fossil fuel-fired electrical power generation in Ontario (1989-91; Ontario Hydro).
- Project director and senior analyst, feasibility and assessment studies related to Burrard Thermal Generating Plant: corporate air quality management strategy; environmental and safety assessment of installation of selective catalytic reduction NO_x technology; technical and economic evaluation of offsite mitigation opportunities (offsets) for NO_x emissions (1991-94; BC Hydro).
- Project director and senior analyst, planning studies for two combined cycle gas turbine (CCGT) power generation plants in BC's Lower Mainland (1992-93; confidential clients).

Hazardous Air Pollutant Assessment and Management

- Consultant to the Canadian Federal-Provincial Advisory Committee on Air Quality (Canadian Council of Ministers of the Environment) *re* priority-setting for hazardous air pollutants (1986-91).
- Coordinator, facilitator and general chairman, CCME National Workshop on Risk Assessment as an Environmental Management Tool (1990).
- Technical co-ordinator, Government of Ontario Hazardous Contaminants Program, a multi-media, multi-agency program (1975-1980).
- Facilitator, national workshop to develop goals and objectives for federal government's Toxic Chemicals Management Program (1981).
- Project manager, development of multi-media priority list of environmental chemicals of concern to Province of Alberta; development of a hazardous air pollutants priority list for Province of BC (1991).

Environmental Management System and Audit Program Development and Auditing

Directed or participated in environmental management system assessment and development, environmental auditing program development and environmental management system auditing for major private sector clients:

- Lead auditor, ISO 14001 pre-registration audit of BC Hydro Surrey Oil Operations EMS (2001; BC Hydro/T&D)
- Consultant, assistance with environmental strategy development, BC Hydro Transmission and Distribution business unit (2000; BC Hydro)
- Auditor, EMS and compliance audit of BC Hydro's corporate management practice for life-cycle management of wooden utility poles (1999/2000; Beak Intl./BC Hydro)

- Lead auditor, EMS performance audit and ISO 14001 gap analysis of BC Hydro's Non-Integrated Area Generation group; field EMS audits of five generating stations throughout BC (1998/99; Beak Intl./BC Hydro).
- Project manager, development of BC Hydro's Burrard Generating Station environmental management system documentation and implementation to meet registration requirements for ISO 14001; registration received 12/98 (1998; Beak Intl./BC Hydro).
- Co-lead auditor, environmental management system audit, BC Hydro Electrical System Operations—integrated hydroelectric and thermal grid dispatch system (1993; Coopers & Lybrand/BC Hydro).
- Lead auditor, comprehensive environmental management audit, Burrard Thermal Generating Plant (1993; Coopers & Lybrand/BC Hydro).
- Senior auditor, comprehensive environmental management system review, including specific responsibility for the company's research facility, for a major corporation in the energy sector on behalf of directors and officers (1991; Confidential client).
- Project manager and lead auditor, comprehensive environmental management system review and development for a major energy sector company on behalf of directors and officers (1990-91; BC Gas).
- Senior auditor, environmental management system review for a major distribution company in the energy sector (1992; Confidential client).
- Project manager, development and implementation of a corporate environmental auditing program for a major power utility (1990-1994; BC Hydro).
- Project manager, comprehensive review, assessment, development and implementation of corporate occupational safety & health management system for a major utility (1993-1995; BC Gas).
- Project manager, development of a corporate chemical and process safety management standard and manual for a pulp & paper manufacturer in B.C. (1996; BOVAR Environmental/MacMillan Bloedel Ltd.).
- Project director, preparation of corporate environmental manager's handbook for Canadian operations of a U.S.-based forest products company (1995; Louisiana-Pacific Inc.).
- Project manager, performance audit and program evaluation of National Air Pollution Surveillance (NAPS) network across Canada (1993; BC Ministry of Environment, Lands & Parks/National Air Issues Coordinating Committee).
- Project manager, review and performance audit of results of first ten years of the Western and Northern Canada Long-Range Transport of Air Pollutants research program (1992; BC Ministry of Environment/WNCLRTAP Technical Committee).
- Project manager, corporate safety management system evaluation and multi-year program development (1992-95; BC Gas)

Industrial Facility Environmental Impact Assessment

Directed or participated in environmental impact assessments or permitting projects for a variety of industrial facilities:

- Project manager, air quality impact assessments of new and modified gas pipeline compressor stations in several projects for BC Gas: East Kootenay system expansions, Southern Crossing Project, Fraser Valley Compressor Station, Inland Pacific Connector (1992-1993, 1996-97, 1998-99, 2000; 2001 BC Gas).

- Activity manager and senior analyst—air quality and environmental management components, comprehensive environmental management plan development for the Kwangyang Bay, South Korea industrial complex region (1997-98. New East Consulting Services/Korea Environment Institute/Korea Ministry of the Environment).
- Project manager, air quality impact assessment for permit requirements of a pulp mill on Vancouver Island, BC. (1995; Avenor Inc.).
- Expert witness, emissions health risk assessment component of successful permittee appeal of BC Environmental Appeal Board decision *re* an oriented-strand board plant in Dawson Creek, BC (1996; Louisiana-Pacific Inc.).
- Senior analyst, integrated measurement, modeling and cumulative environmental impact assessment of emissions from an oil sands plant in Alberta (1984-85; Syncrude Canada Ltd.).
- Project manager, emissions modeling and air quality impact assessment for a cement plant in British Columbia (1993-95, 1997; Tilbury Cement Ltd.).
- Project director, air quality modeling and ambient air monitoring for emissions from an oriented-strand board plant in B.C.—pre- and post-operations (1992-93; Norecol Consultants/Ainsworth Lumber Co.).
- Project manager, facility process hazards reviews in 10 B.C. pulp & paper mills and a related chemical plant (1995-96; Clients: BOVAR Environmental/MacMillan Bloedel, Weyerhaeuser Canada, Cariboo Pulp & Paper, Quesnel River Pulp, Crestbrook Forest Industries, Canadian Forest Products, Repap BC/Skeena Cellulose, Celgar Pulp Co.).
- Project manager, quantitative risk analysis of toxic chemical releases from a major Western Canada chlorine plant (1992-1996; BOVAR Environmental/CXY Chemicals).

Regulatory and Environmental Assessment Proceedings

Provided expert testimony as consultant to proponents, regulatory agencies and intervenor public groups in quasi-judicial proceedings in a variety of jurisdictions in Canada:

- British Columbia Environmental Appeal Board *re* Louisiana-Pacific's oriented-strand board plant at Dawson Creek, British Columbia (1996, Louisiana-Pacific, the appellant).
- British Columbia Utilities Commission hearing of BC Hydro's application for an energy removal certificate for power export (1992, BC Hydro).
- Federal-Provincial Environmental Assessment Review Process *re* Port Hardy, British Columbia ferrochromium plant (1990, for the Panel and all interveners—pro and con).
- Federal-provincial Environmental Assessment Review Process *re* Alberta-Pacific pulp mill at Athabasca, Alberta (1991, for the Prosperity Citizens Group).
- Ontario Environmental Assessment Board *re* municipal waste-to-energy facility at Peel, Ontario—the first private sector project heard by the Board (1988, for the proponent).
- Ontario Commission on Regulatory Control of Mobile PCB Destruction Facilities (1987, for the Regional Municipality of Halton).
- Alberta Energy Resources Conservation Board *re* Syncrude Canada Ltd's licence application for lease extension (1984, Syncrude Canada Ltd.).
- Ontario Environmental Assessment and Municipal Boards *re* reclamation of asbestos waste disposal site—first development of a consensus position of proponent and interveners in a Canadian environmental hearing (1986, for the Joint Boards and a citizens group).

- Canadian Federal Board of Inquiry into Urea Formaldehyde Foam Insulation *re* quality control & quality assurance of monitoring methods (1984, Department of Consumer & Corporate Affairs Canada).

Technology Development & Assessment

- Director, multi-year R&D program for monitoring formaldehyde emissions and indoor air quality related to urea-formaldehyde foam insulation (UFFI). Developed and coordinated more than \$1 million in R&D on novel passive sampling and analytical technology for use in homes. Oversaw production and quality assurance for manufacture of more than 10,000 units used in pilot study of 2,500 homes and full-scale study of 25,000 homes in Canada (1981-1985; National Research Council of Canada & Consumer & Corporate Affairs Canada).
- Director, R&D component of a joint venture to demonstrate a patented ultraviolet photolytic process to remove both NO_x and SO₂ from power plant flue gas streams; oversaw and evaluated results of \$1 million program to build and test bench-scale demonstration (1986-88; for Concord Scientific Corp., EXXON Inc., General Electric Inc., with earlier support from NRC IRAP and Ontario Hydro).